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Shin

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(54) **SCANNING APPARATUS AND IMAGE FORMING APPARATUS HAVING THE SAME**

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E05D 7/04 (2006.01)
H04N 1/00 (2006.01)

(52) **U.S. Cl.**
CPC ***H04N 1/00554*** (2013.01); ***G03G 15/605*** (2013.01); ***H04N 1/00543*** (2013.01); ***H04N 1/00557*** (2013.01); *G03G 2221/16844* (2013.01)
USPC **399/380**; 399/367; 399/362; 16/242; 16/245

(58) **Field of Classification Search**
USPC 399/380, 362; 16/248, 235, 309, 375, 16/242, 245, 247, 249, 364, 360, 362
See application file for complete search history.

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(57) **ABSTRACT**

A scanning apparatus and an image forming apparatus having the same. The scanning apparatus includes: a main body having a scanning unit; a cover to open and close upon an upper surface of the main body; a hinge unit disposed on one of the main body and the cover so that the cover is rotatable with respect to the main body; a hinge accommodating unit disposed on the other of the main body and the cover to accommodate the hinge unit so that the cover is movable in an upward and downward direction with respect to the upper surface of the main body; and a movement restricting unit disposed on at least one of the hinge unit and the hinge accommodating unit to restrict a movement of the cover in the upward and downward direction.

20 Claims, 9 Drawing Sheets

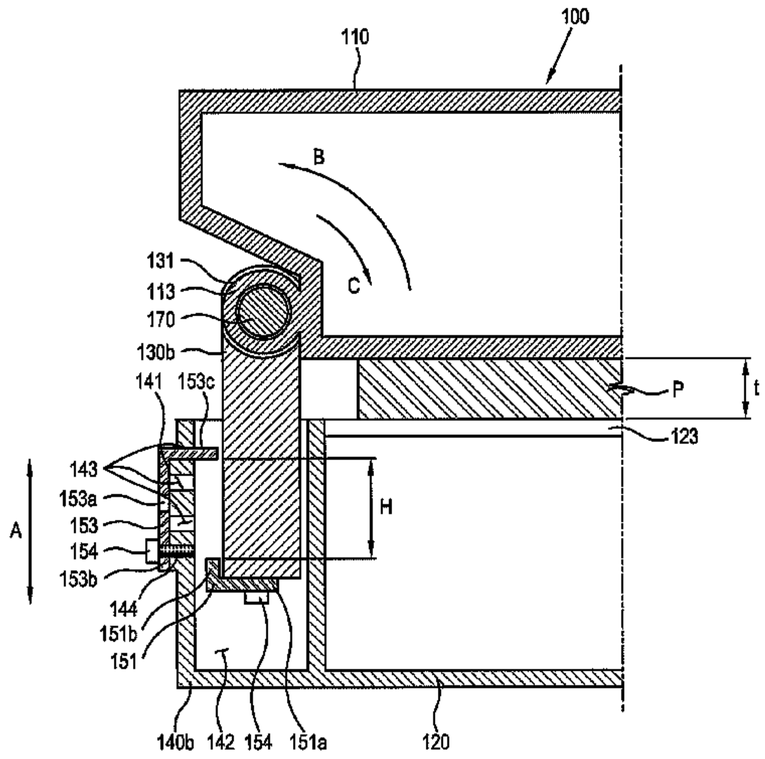


FIG. 1

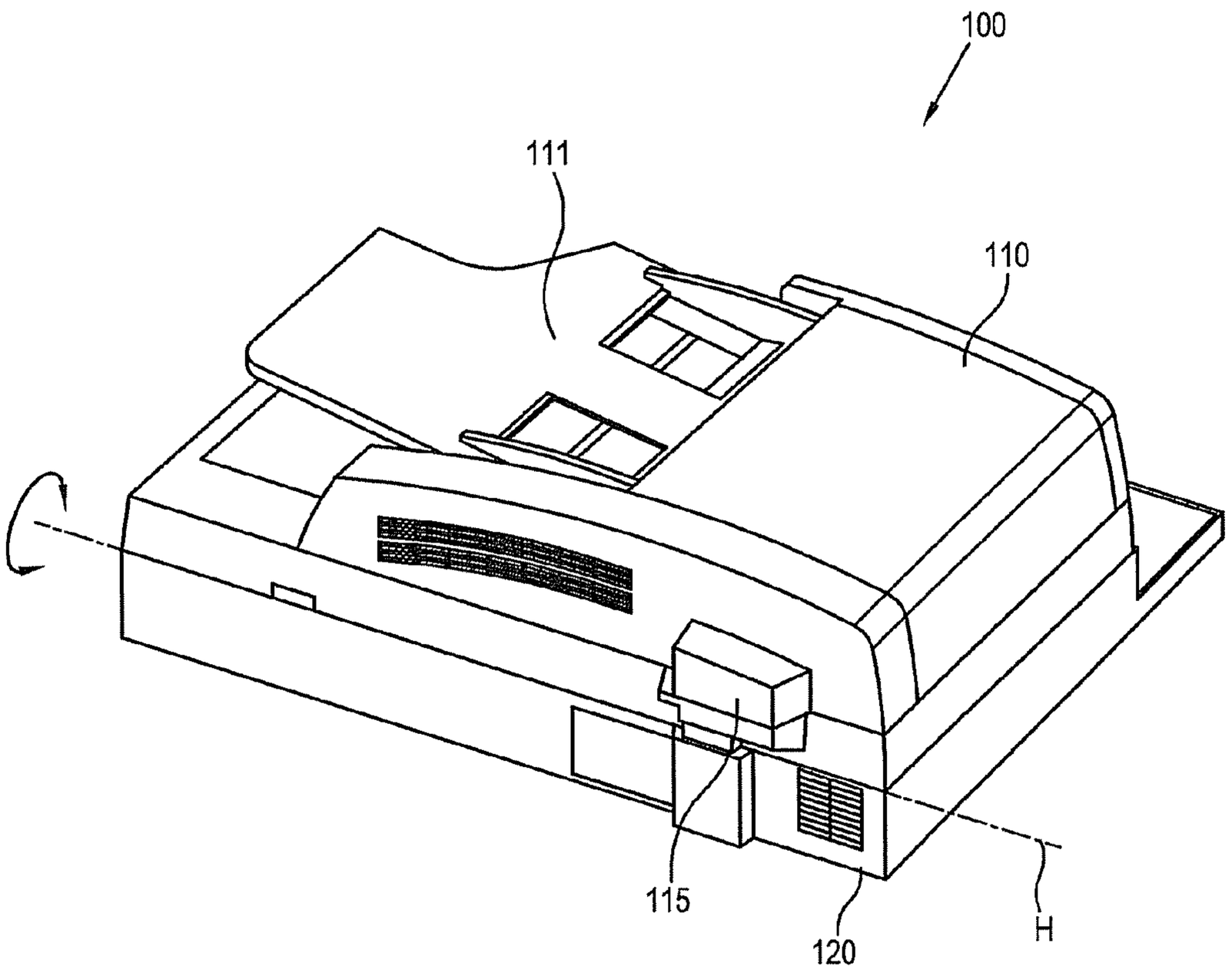


FIG. 2

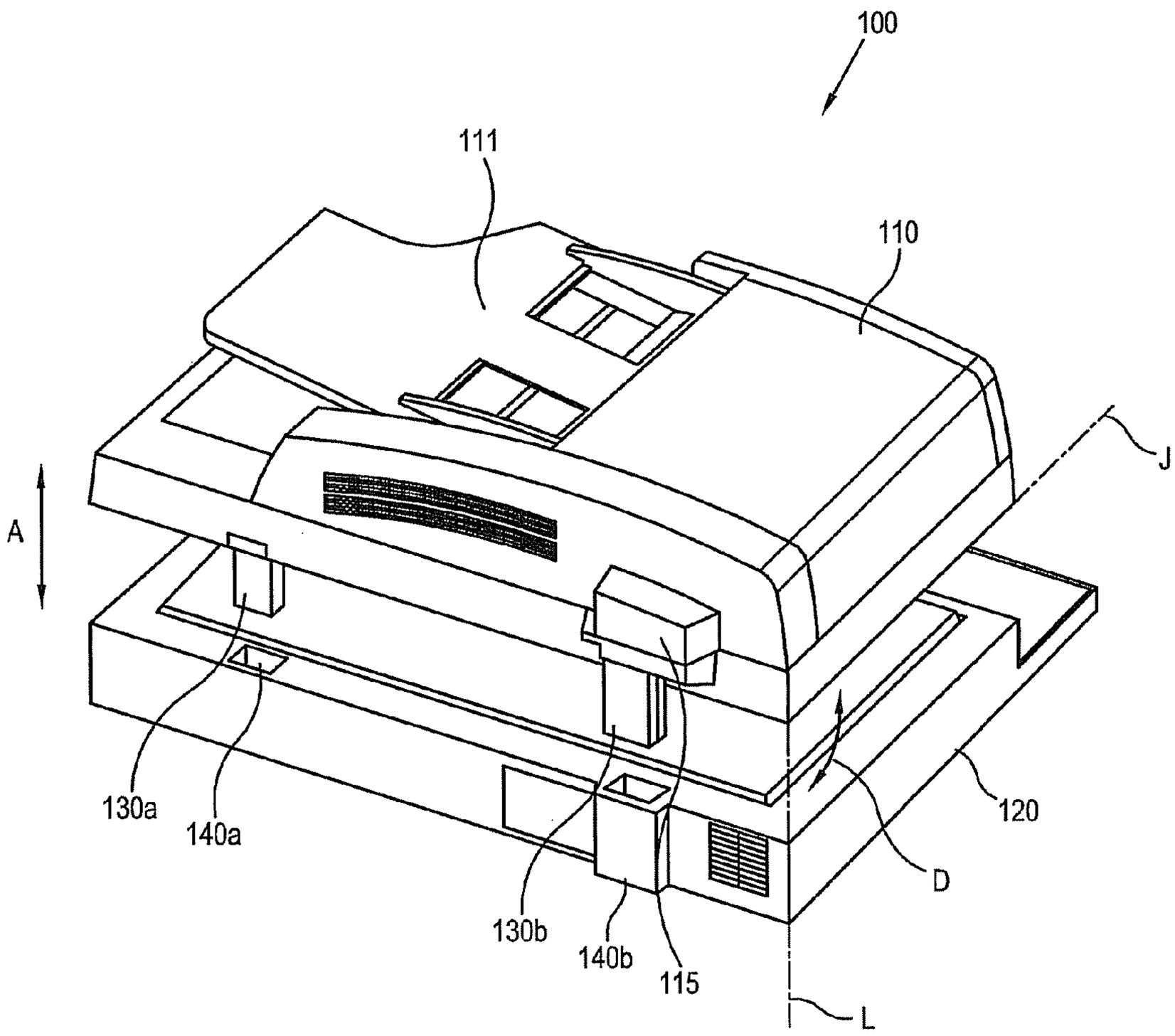


FIG. 3

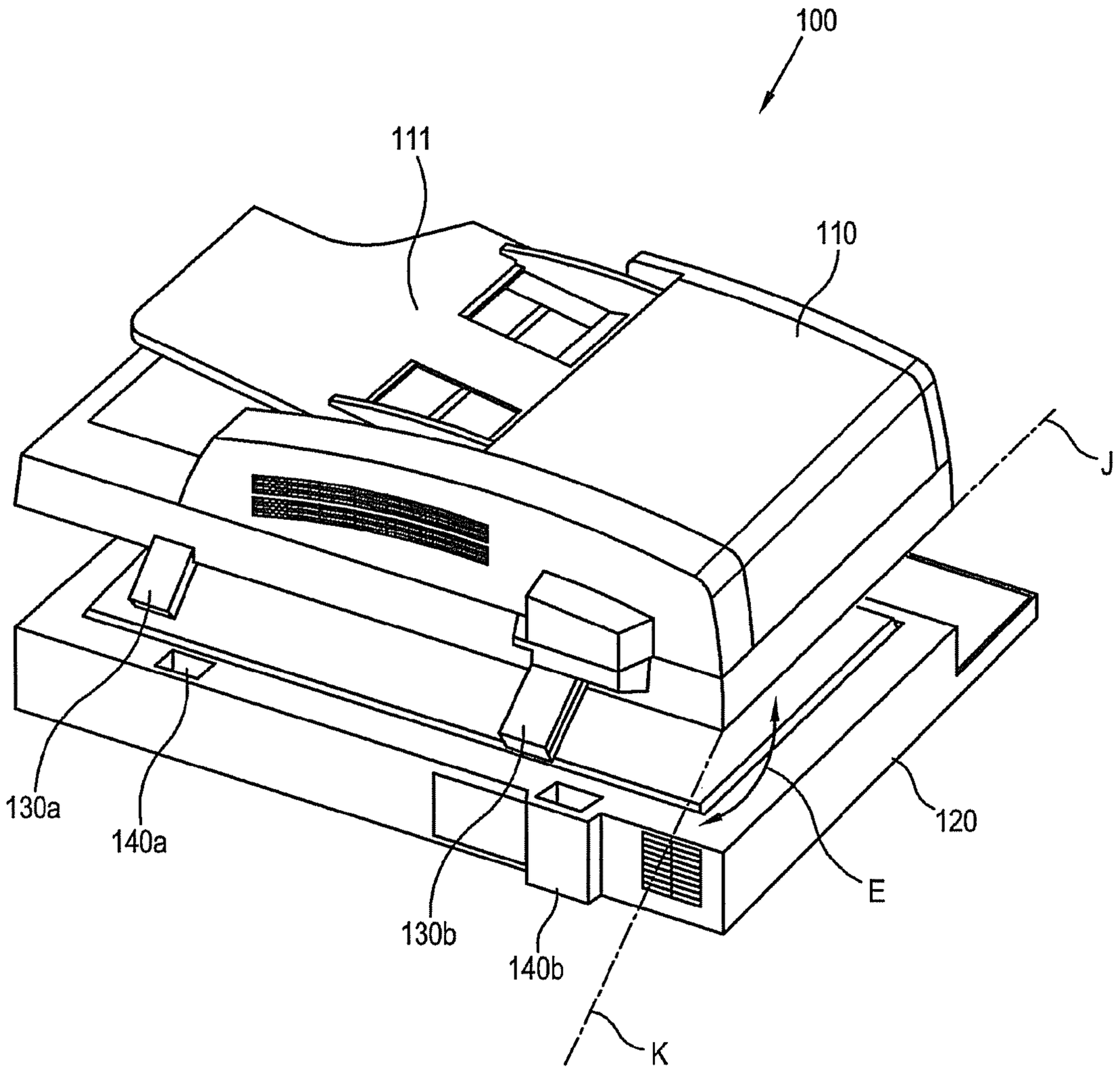


FIG. 4

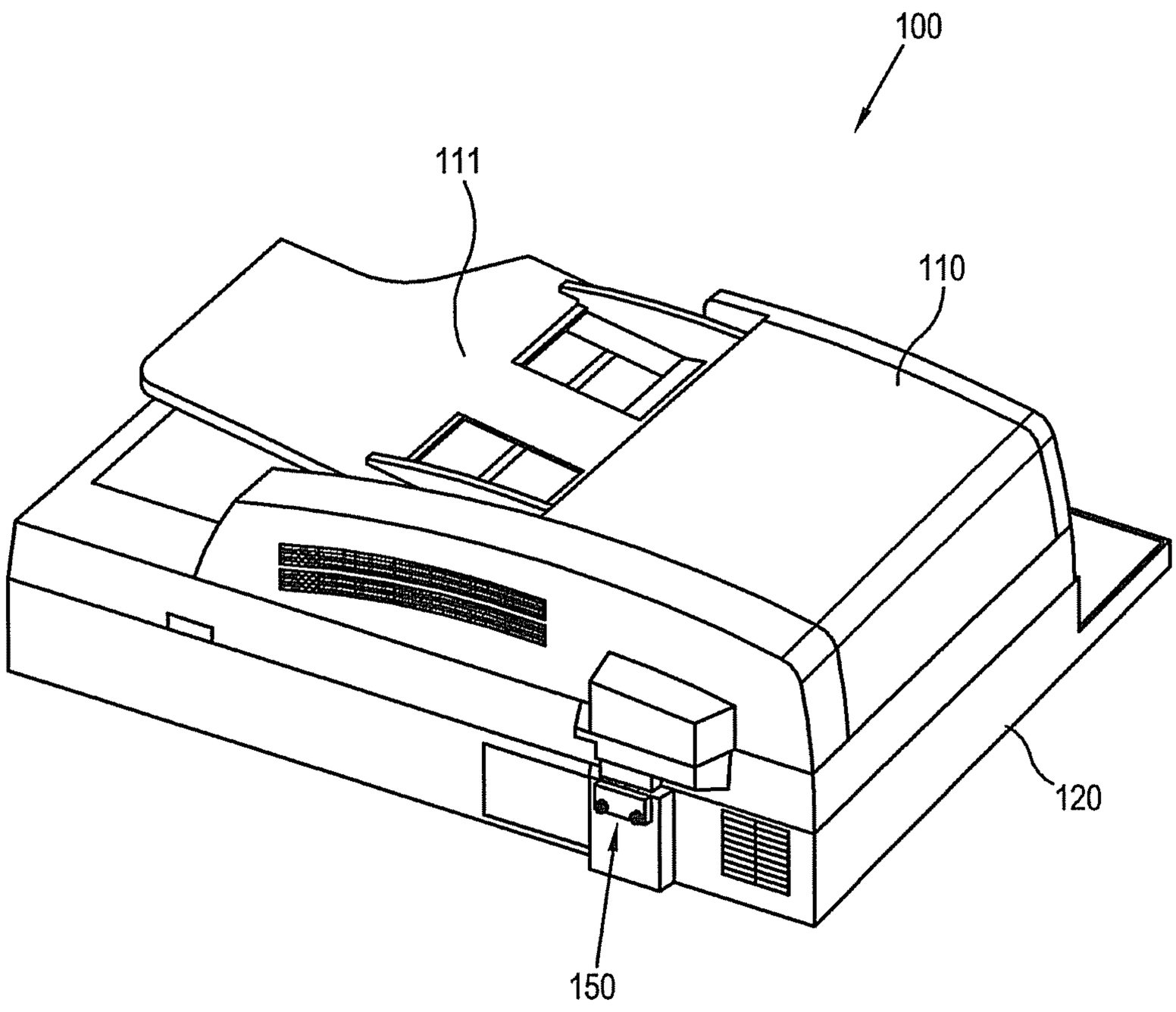


FIG. 5

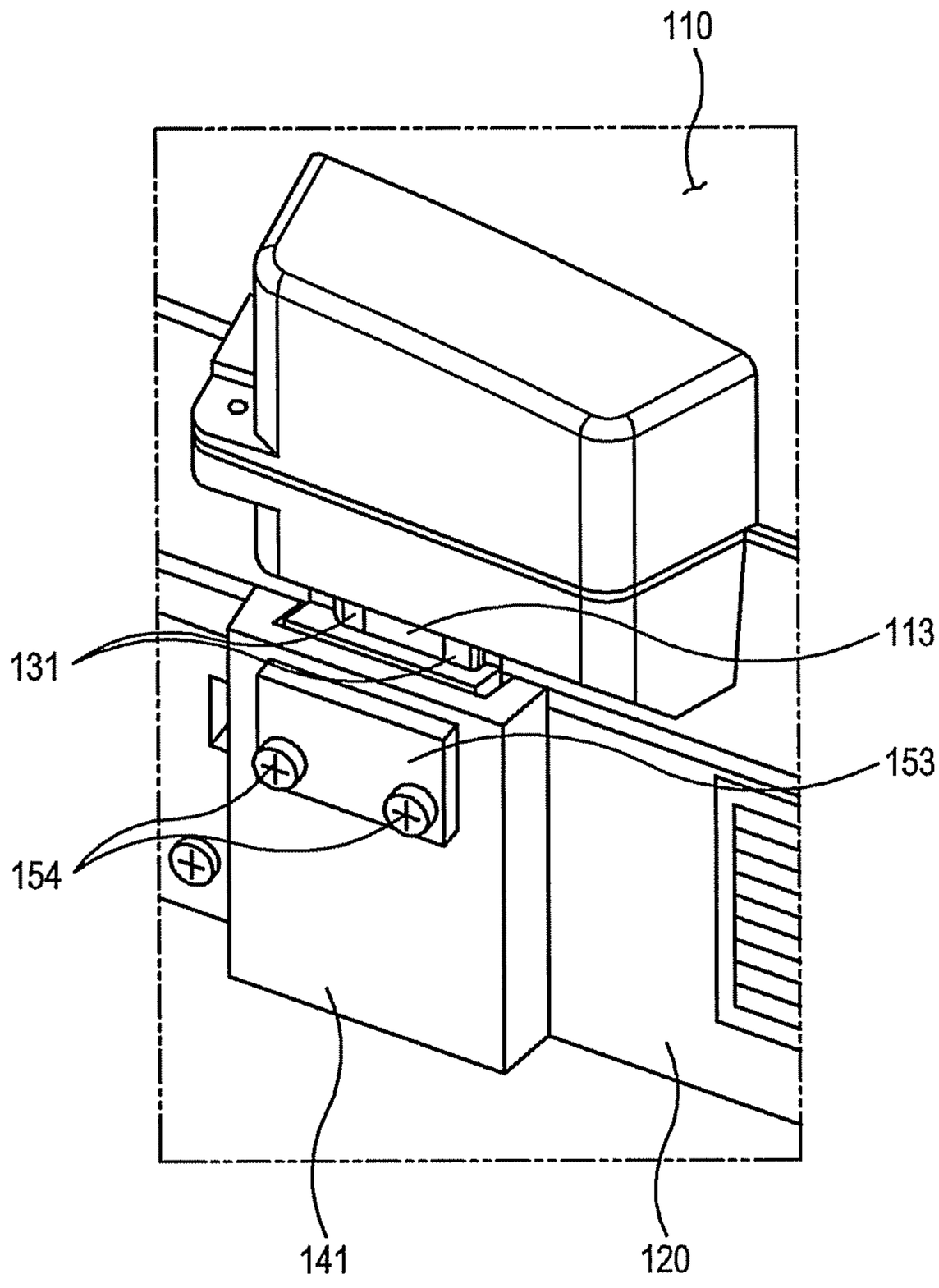


FIG. 6

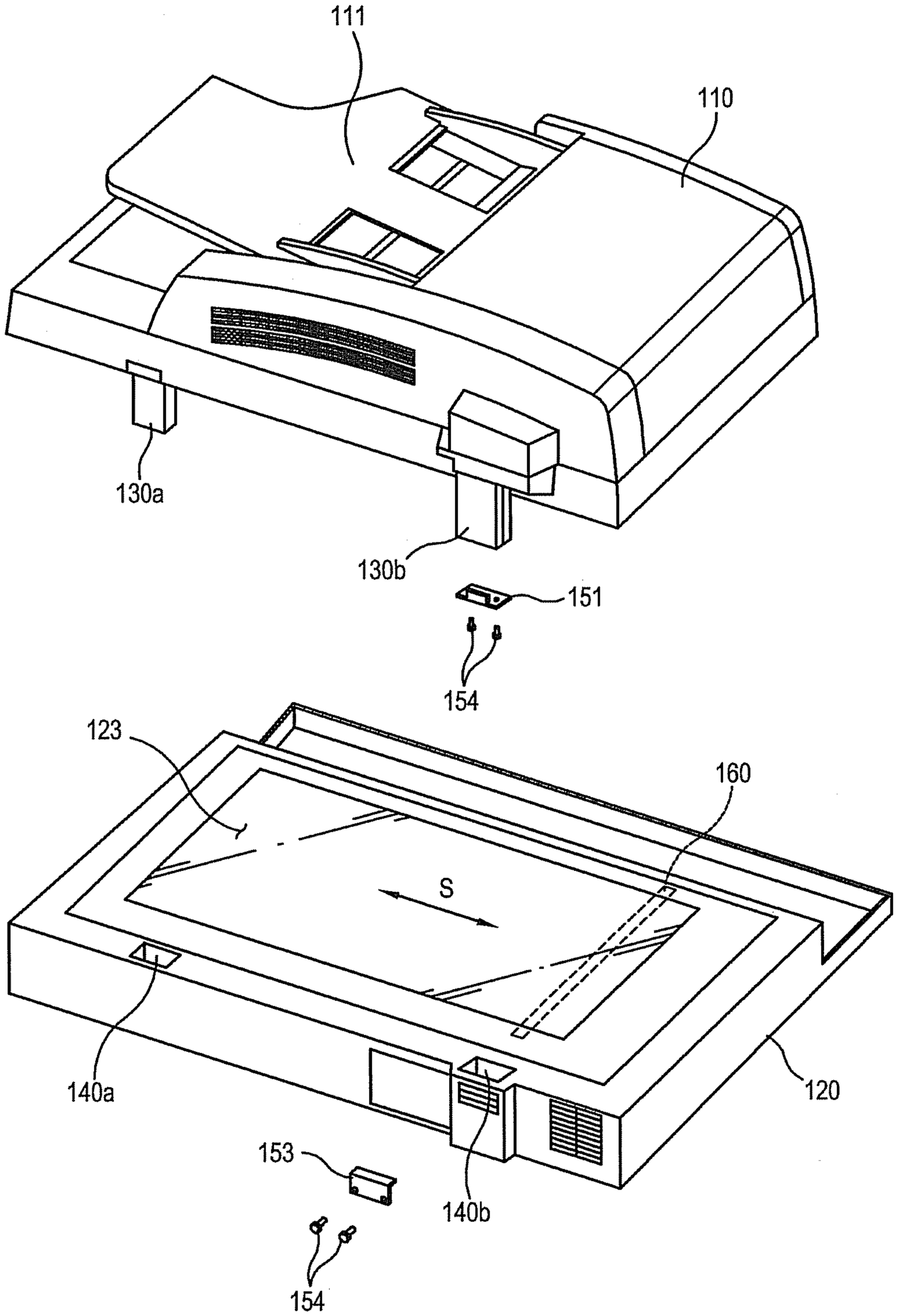


FIG. 7

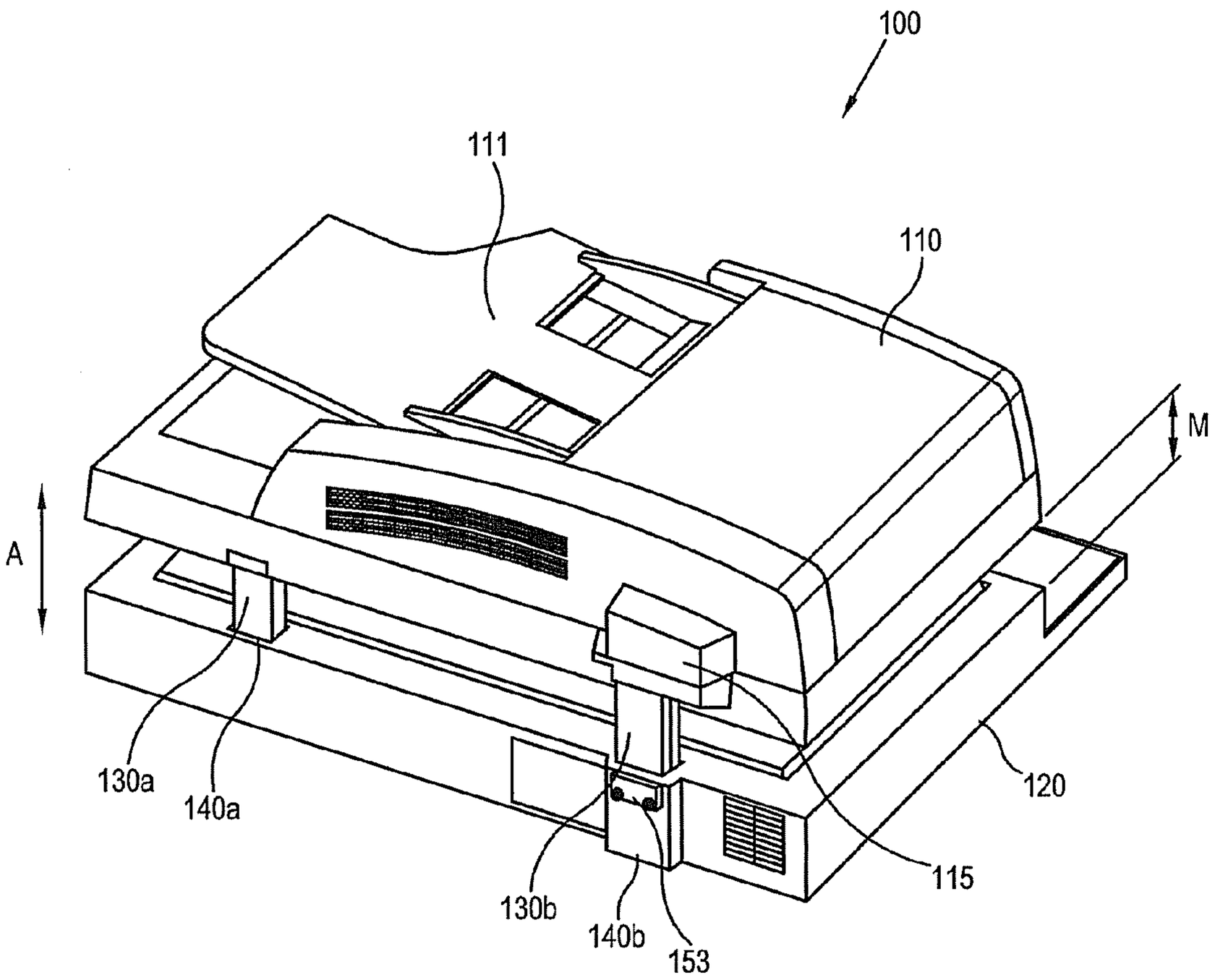


FIG. 8

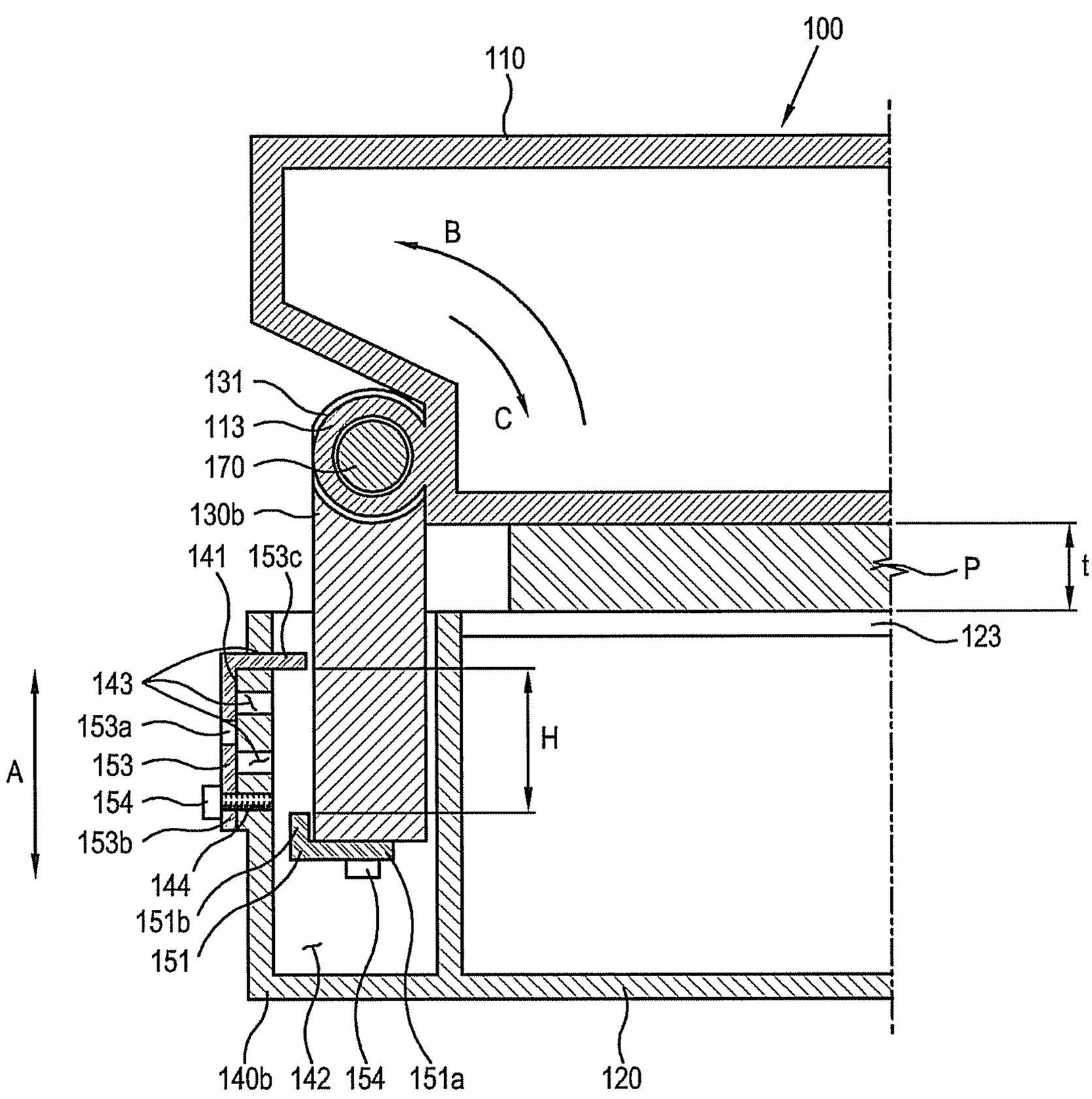
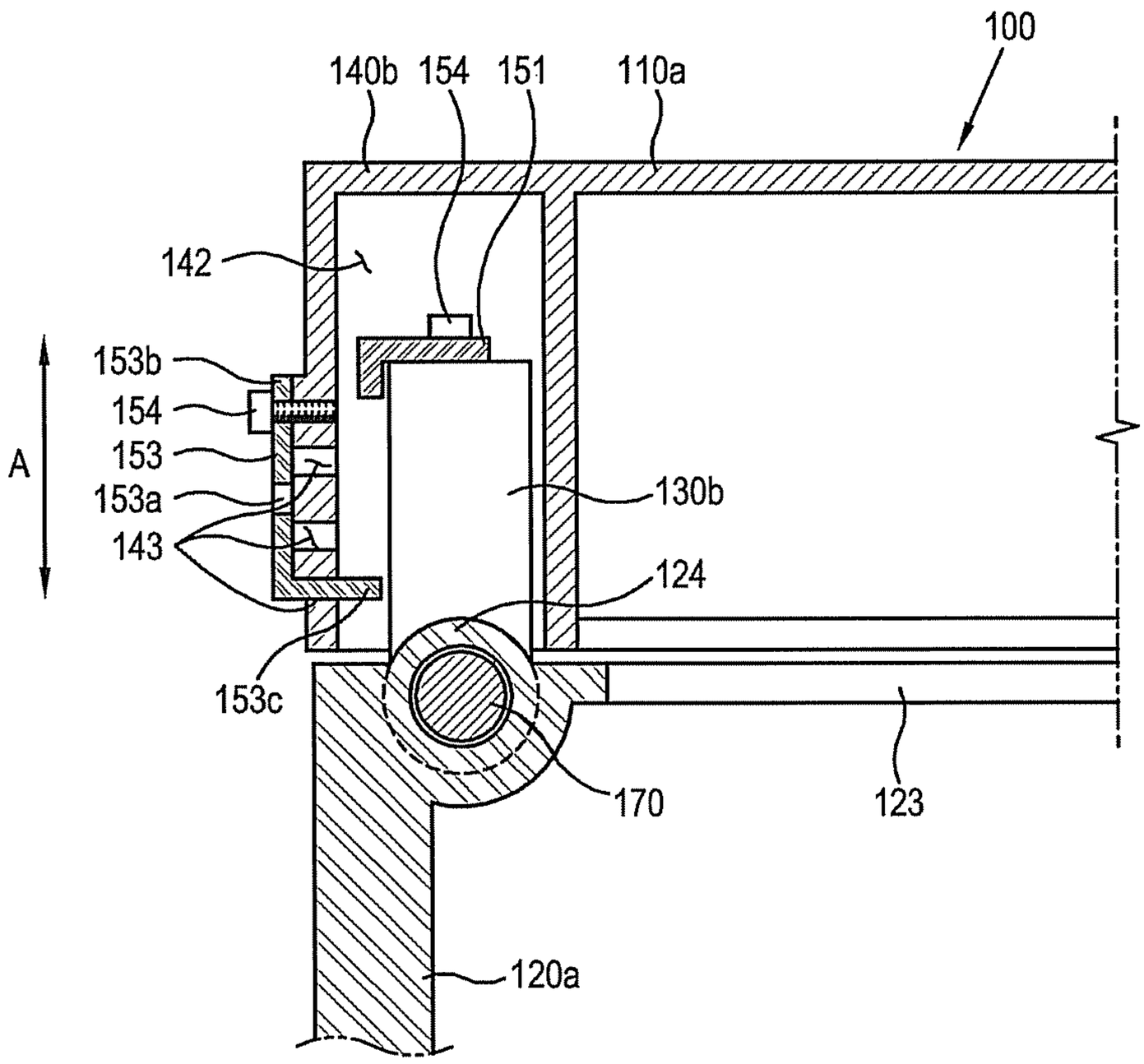

100
110
B
C
131
113
170
130b
141
153c
P
t
123
143
153a
153
154
153b
A
H
144
151b
151
140b
142
154
151a
120

FIG. 9


100
140b
154
151
110a
142
153b
154
153
153a
143
A
130b
124
153c
170
123
120a

SCANNING APPARATUS AND IMAGE FORMING APPARATUS HAVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

This application claims benefit of Korean Application No. 10-2008-0079145, filed Aug. 12, 2008 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

Aspects of the present invention relate to a scanning apparatus and an image forming apparatus having the same, and more particularly to a scanning apparatus capable of improving maintenance and user safety, and an image forming apparatus having the same.

2. Description of the Related Art

An image forming apparatus forms an image on a printing medium (the printing medium may be paper, a transparency, an adhesive label or sticker, etc.), and the image forming apparatus may be an electronic copier, a printer, a multifunction device, a facsimile, or other such devices. Also, the image forming apparatus, such as the electronic copier, includes a scanning apparatus for scanning an image appearing on a document to be scanned, and includes a scanning apparatus having an automatic document feeder (ADF) for automatically transporting the document to be scanned to a scanning unit of the scanning apparatus.

The automatic document feeder is disposed on an upper side of a main body of the scanning apparatus, and a transparent flat glass is disposed on an upper surface of the main body so that a user can manually dispose a document to be scanned thereon. Also, the automatic document feeder rotates so as to open and close upon the upper surface of the main body.

However, for maintenance of the automatic document feeder, the automatic document feeder should easily detach from the main body.

Also, in scanning a book or a thick document, it is preferable that the automatic document feeder is movable in an up and down direction to some extent so that the automatic document feeder can stably press the book or the thick document.

Also, if a user detaches the automatic document feeder from the main body by mistake, factors which bodily harm or physically injure the user should be prevented.

SUMMARY OF THE INVENTION

Accordingly, it is an aspect of the present invention to provide a scanning apparatus enabling a user to safely use the scanning apparatus, and an image forming apparatus having the same.

Another aspect of the present invention is to provide a scanning apparatus allowing easy maintenance of the scanning apparatus, and an image forming apparatus having the same.

Another aspect of the present invention is to provide a scanning apparatus capable of stably scanning a thick document, and an image forming apparatus having the same.

Aspects of the present invention provide a scanning apparatus, including: a main body having a scanning unit; a cover to open and close upon an upper surface of the main body; a hinge unit disposed on one of the main body and the cover so that the cover is rotatable with respect to the main body; a hinge accommodating unit disposed on the other of the main body and the cover to accommodate the hinge unit so that the cover is movable in an upward and downward direction with respect to the upper surface of the main body; and a movement restricting unit disposed on at least one of the hinge unit and the hinge accommodating unit to restrict a movement of the cover in the upward and downward direction.

The cover may include an automatic document feeder which transports a document to be scanned to the scanning unit.

The movement restricting unit may include: an engagement unit disposed on one of the hinge unit and the hinge accommodating unit, and an engagement projection disposed on a position of the other of the hinge unit and the hinge accommodating unit at a predetermined interval distance in the upward and downward direction with respect to the engagement unit contacting the engagement unit if the cover moves upwardly with respect to the upper surface of the main body.

The engagement unit and the engagement projection may be detachably coupled to the hinge unit and the hinge accommodating unit.

The engagement projection may include an accommodating unit coupling piece coupled to the hinge accommodating unit, and an internal protruding piece protruding towards an inner part of the hinge accommodating unit, and the engagement unit may include a hinge unit coupling piece coupled to a lower part of the hinge unit, and an external protruding piece protruding to an outer part of the hinge unit to contact the internal protruding piece in an inner part of the hinge accommodating unit.

The scanning apparatus may further include a coupler detachably coupling the accommodating unit coupling piece and the hinge accommodating unit.

The hinge accommodating unit may further include a plurality of thru-holes formed in the upward and downward direction to allow the internal protruding piece to pass through to adjust the predetermined interval distance between the engagement projection and the engagement unit.

The hinge accommodating unit may include a hinge unit accommodating space formed in an upward and downward direction to accommodate the hinge unit, and the hinge unit extends in the upward and downward direction to slide in the hinge unit accommodating space.

The scanning apparatus may further include an elastic member elastically biasing the cover so that the cover is rotatable in a direction of opening the upper surface of the main body.

Aspects of the present invention provides an image forming apparatus, including: the above scanning apparatus; and an image forming unit to form on a printing medium an image corresponding to image data of a document to be scanned by the scanning unit.

The movement restricting unit comprises an engagement unit disposed on one of the hinge unit and the hinge accommodating unit, and an engagement projection disposed on a position of the other of the hinge unit and the hinge accommodating unit at a predetermined distance interval in the upward and downward direction with respect to the engagement unit and contacting the engagement unit if the cover moves upwardly with respect to the upper surface of the main body.

The engagement unit and the engagement projection may be detachably coupled to the hinge unit and the hinge accommodating unit.

The engagement projection may include an accommodating unit coupling piece coupling the hinge accommodating unit, and an internal protruding piece protruding towards an inner part of the hinge accommodating unit, and the engagement unit may include a hinge unit coupling piece coupled to a lower part of the hinge unit, and an external protruding piece protruding to an outer part of the hinge unit to contact the internal protruding piece in an inner part of the hinge accommodating unit.

The image forming apparatus may further include a coupler detachably coupling the accommodating unit coupling piece and the hinge accommodating unit.

The hinge accommodating unit may further include a plurality of thru-holes formed in the upward and downward direction, and allowing the internal protruding piece to pass through to adjust the predetermined interval between the engagement projection and the engagement unit.

The hinge accommodating unit may include a hinge unit accommodating space formed in an upward and downward direction to accommodate the hinge unit, and the hinge unit extends in the upward and downward direction to slide in the hinge unit accommodating space.

The cover may rotate in a direction closing the upper surface of the main body by its own weight, and the image forming apparatus may further include an elastic member elastically biasing the cover so that the cover is rotatable in a direction of opening the upper surface of the main body.

Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a schematic perspective view of a scanning apparatus according to a first embodiment of the present invention;

FIG. **2** is a schematic perspective view illustrating a cover of the scanning apparatus in FIG. **1** moved upwardly;

FIG. **3** is a schematic perspective view illustrating a hinge unit disposed to the cover in FIG. **2** elastically restored by an elastic member;

FIG. **4** is a schematic perspective view of the scanning apparatus in FIG. **1** provided with a movement restricting unit;

FIG. **5** is an enlarged perspective view illustrating a main portion of FIG. **4**;

FIG. **6** is an exploded perspective view of the scanning apparatus in FIG. **5**;

FIG. **7** is a schematic perspective view illustrating the cover of the scanning apparatus in FIG. **4** moved upwardly;

FIG. **8** is an enlarged sectional main portion view illustrating a document inserted to the scanning apparatus in FIG. **4**; and

FIG. **9** is an enlarged sectional main portion view of a scanning apparatus according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Reference will now be made in detail to the present embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

According to a first embodiment of the present invention, as shown in FIG. **1**, a scanning apparatus **100** includes a cover **110** and a main body **120**.

The main body **120** includes a scanning unit **160**, as shown in FIG. **6**, scanning a document to generate an image data corresponding to an image of the scanned document.

The cover **110** is disposed on an upper surface of the main body **120**, and rotates about a hinge pivot line H to open and close upon the upper surface of the main body **120**.

The cover **110** may include an automatic document feeder (ADF) **110***a* transporting a document to be scanned that is put on a document table **111** toward the scanning unit **160** in FIG. **6**.

As shown in FIG. **6**, the upper surface of the main body **120** includes a platen **123** formed of transparent glass. The document to be scanned may be put on the document table **111**, and automatically transported to be scanned, or the document to be scanned may be put on the platen **123** manually to be scanned. The scanning unit **160** is disposed on a lower part of the platen **123**, and the scanning unit **160** scans an image of the document to be scanned that is put on the platen **123** while moving along a scanning direction S. The automatic document feeder **110***a* transports the document to be scanned that is put on the document table **111** to the platen **123**, the transported document is scanned, and the scanned document is discharged after completing the scanning. The transporting, scanning and discharging processes are repeated for the next sheet of the scanned document, thereby performing an automatic scanning for a plurality of sheets of documents.

As shown in FIG. **2**, an image forming apparatus **100** includes a plurality of hinge units **130***a* and **130***b* enabling the automatic document feeder **110***a* to rotate about the hinge pivot line H, as shown in FIG. **1**, so that the automatic document feeder **110***a* can open and close upon the upper surface of the main body **120**, and a plurality of hinge accommodating units **140***a* and **140***b* respectively accommodating the plurality of hinge units **130***a* and **130***b*. Two hinge units **130***a* and **130***b* and two hinge accommodating units **140***a* and **140***b* are illustrated in the present embodiment, however, aspects of the present invention are not limited thereto.

The hinge units **130***a* and **130***b* are coupled to the automatic document feeder **110***a* to rotate about the hinge pivot **170** in FIG. **8**.

The automatic document feeder **110***a* and the hinge units **130***a* and **130***b* are respectively provided with hinge pivot insertion units **113** and **131**, as shown in FIGS. **5** and **8**, to which the hinge pivot **170** in FIG. **8** is inserted.

Also, for convenience of repair, as shown in FIG. **2**, the hinge units **130***a* and **130***b* may be separated from the hinge accommodating units **140***a* and **140***b* if the cover **110** is lifted up from the main body **120** in an upward direction A.

Also, since the weight of the automatic document feeder **110***a* is considerable, the automatic document feeder **110***a* is not easily lifted when a user rotates and opens the automatic document feeder **110***a*.

Accordingly, an elastic member (not shown) elastically biasing the automatic document feeder **110***a* so that the automatic document feeder **110***a* is rotatable in a direction of opening the upper surface of the main body **120** may be further provided so that a user can further easily rotate and open the automatic document feeder **110***a*. The elastic member is disposed on the hinge pivot **170** in FIG. **8**, and as shown in FIG. **3**, elastically biases the hinge units **130***a* and **130***b* so that an angle E between an extending line K of the hinge units

130*a* and 130*b* and a lower surface of the automatic document feeder 110*a* can have an obtuse angle in a balance state.

As shown in FIG. 2, if the hinge units 130*a* and 130*b* are accommodated on the hinge accommodating units 140*a* and 140*b*, because the hinge units 130*a* and 130*b* are prevented from rotating due to interference with the hinge accommodating units 140*a* and 140*b*, an angle D between an extending direction L of the hinge units 130*a* and 130*b* and the lower surface of the automatic document feeder 110*a* becomes smaller than that of the balance state described above. Accordingly, an elastic force of the elastic member is applied to the cover 110. In other words, the elastic force of the elastic member is applied in direction B, as shown in FIG. 8, to rotate and open the automatic document feeder 110*a*.

The automatic document feeder 110*a* rotates in direction C, as shown in FIG. 8, to close upon the upper surface of the main body 120 due to the weight of the automatic document feeder 110*a*.

Although the automatic document feeder 110*a* close upon the upper surface of the main body 120 due to its own weight, since the elastic force by the elastic member is added thereto as a user lifts up the automatic document feeder 110*a*, the user is capable of lifting up the automatic document feeder 110*a* by applying less force.

As shown in FIG. 2, the hinge units 130*a* and 130*b* may extend in an upward and downward direction A so that the automatic document feeder 110*a* can elevate in the upward and downward direction A. The hinge units 130*a* and 130*b* can elevate in the upward and downward direction A and can be inserted in the hinge accommodating units 140*a* and 140*b* so that the automatic document feeder 110*a* can elevate in the upward and downward direction A at a side to which the hinge units 130*a* and 130*b* are disposed, and concurrently, is rotatable about the hinge pivot line H.

Accordingly, if a thick document P, as shown in FIG. 8, is put on the platen 123, since the automatic document feeder 110*a* is capable of pressing the document P by being moved in the upward direction A by the thickness of the document P, a surface of the document P is flatly disposed on a surface of the platen 123. Accordingly, quality of a scanning data acquired according to scanning a thick document can be improved.

For example, when a part of a book is to be copied and the book is opened and put on the platen 123, the exposed pages of the book may closely contact the platen 123. However, a central part of the book to be copied may be substantially distanced from the platen 123, and accordingly, the focal distance from the scanning unit 160 to an image surface of the document to be scanned varies so that a scanning data corresponding to the central part of the book may be darker than that of a scanning data corresponding to the outer part of the book, and clarity of the scanning data corresponding to the outer part of the book deteriorates. Accordingly, since the automatic document feeder 110*a* moves in the upward direction A at the central part of the book disposed on the platen 123 to press the central part of the book, the book can closely contact the platen 123, thereby improving the quality of a scanned image.

The hinge accommodating units 140*a* and 140*b* may be provided in shapes corresponding to the hinge units 130*a* and 130*b*. As the hinge units 130*a* and 130*b* extend in the upward and downward direction A, the hinge accommodating units 140*a* and 140*b* may include a hinge unit accommodating space 142 in FIG. 8 extending in the upward and downward direction A to correspond thereto.

The automatic document feeder 110*a* further includes a roller (not shown) for transporting a document to be scanned that is put on the document table 111 to the scanning unit 160, and a driving motor (not shown) for rotating the roller. The driving motor may be disposed inside a driving motor accommodating unit 115.

The driving motor accommodating unit 115 may be provided to outwardly protrude from the automatic document feeder 110*a* in correspondence to the size of the driving motor.

Here, if a user mistakes the protruding driving motor accommodating unit 115 for a handle, and lifts the automatic document feeder 110*a* in the upward direction A, the hinge unit 130*b* is extended in a direction corresponding to the lifting as the hinge unit 130*b* is separated from the hinge accommodating unit 140*b* while an elastic member applies an elastic force. Accordingly, as the hinge unit 130 extends, a hand of the user holding the driving motor accommodating unit 115 may be caught between the hinge unit 130*b* and the main body or between other units of the image forming apparatus and may be injured.

To prevent this, the scanning apparatus 100 may further include a movement restricting unit 150 disposed on either the hinge unit 130*b* or the hinge accommodating unit 140*b* to restrict a movement in the upward and downward direction A of the cover 110 or the automatic document feeder 110*a*.

As shown in FIGS. 4 to 8, the movement restricting unit 150 includes an engagement unit 151 and an engagement projection 153.

The engagement unit 151 is disposed on either the hinge units 130*a* and 130*b* or the hinge accommodating units 140*a* and 140*b*, and the engagement projection 153 is disposed on either the hinge units 103*a* and 130*b* or the hinge accommodating units 140*a* and 140*b* of which the engagement unit 151 is not disposed on, and is disposed to a position distanced from the engagement unit 151 by a predetermined interval H in the upward direction A. Accordingly, if the engagement unit 151 and the engagement projection 153 contact each other and interfere with each other, the hinge units 130*a* and 130*b* are prevented from being completely separated from the hinge accommodating units 140*a* and 140*b*, thereby restricting an upward movement thereof. Here, as shown in FIG. 8, since the predetermined interval H is an interval between the engagement unit 151 and the engagement projection 153 under the state that the document P is interposed between the automatic document feeder 110*a* and the platen 123, as shown in FIG. 7, a maximum distance interval M between the engagement unit 151 and the engagement projection 153 in the upward direction A becomes a value H+t which is the predetermined interval H added with the thickness t of the document P. That is, the cover 110 and the automatic document feeder 110*a* can move the maximum distance interval M in the upward direction A from the upper surface of the main body 120.

As shown in FIG. 7, although a user holds the driving motor accommodating unit 115 and lifts up the automatic document feeder 110*a*, the engagement unit 151 and the engagement projection 153 interfere with each other so that the hinge units 130*a* and 130*b* can be prevented from being separated from the hinge accommodating units 140*a* and 140*b*. Accordingly, an injury to the user can be prevented.

Also, the engagement projection 153 includes an accommodating unit coupling piece 153*b* coupled to an outer surface 141 of the hinge accommodating unit 140*b*, as shown in FIG. 8, and an internal protruding piece 153*c* protruding toward an inner part of the hinge accommodating unit 140*b*. Here, the accommodating unit coupling piece 153*b* and the hinge accommodating unit 140*b* are coupled by a coupler 154 such as a bolt which is capable of being detachably coupled.

Accordingly, if a user lifts up the driving motor accommodating unit **115** by mistake, the engagement unit **130***b* can be prevented from being separated from the hinge accommodating unit **140***b* by the interference between the engagement projection **153** and the engagement unit **151**, thereby preventing an accident to the user.

Also, if it is necessary to detach the automatic document feeder **110***a* from the main body **120** for maintenance or repair, it is sufficient to disassemble the coupler **154** in order to detach the engagement projection **153** from the hinge accommodating unit **140***b*, thereby easily maintaining or repairing the scanning apparatus **100**.

The hinge accommodating unit **140***b* includes a tap hole **144** formed with a female screw thread engaged with a male screw thread of the coupler **154**.

The engagement unit **151** includes a hinge unit coupling piece **151***a* coupled to a lower part of the hinge unit **130***b*, and an external protruding piece **151***b* protruding to an outer part of the hinge unit **130***b* to contact with the internal protruding piece **153***c* in an inner part of the hinge accommodating unit **140***b*.

Also, as shown in FIG. **8**, the hinge accommodating unit **140***b* includes a plurality of thru-holes **143** formed in the upward and downward direction A to adjust the predetermined internal distance H between the engagement unit **151** and the engagement projection **153**.

The internal protruding piece **153***c* of the engagement projection **153** is disposed to pass through one of the plurality of thru holes **143** so that the predetermined interval H can be adjusted. For example, as shown in FIG. **8**, the internal protruding piece **153***c* is illustrated to pass through a thru hole **143** of the most top position. Alternatively, the internal protruding piece **153***c* may be disposed to pass through a thru hole **143** of a central position as necessary. Here, if the engagement projection **153** is disposed to the thru hole **143** of the central position, a coupling hole **153***a* formed to the engagement projection **153** may be provided to accord to the tab hole **144**. Accordingly, the engagement projection **153**, the interval of which is adjusted can be coupled to the hinge accommodating unit **140***b* again with the same coupler **154**.

As described above, the movement restricting unit **150** is illustrated, as seen in FIG. **5**, to be disposed on only the hinge unit **130***b* and the hinge accommodating unit **140***b* of the right side among the hinge units **130***a* and **130***b* and the hinge accommodating units **140***a* and **140***b* of the opposite sides. Alternatively, the movement restricting unit **150** may be disposed on only the hinge unit **130***a* and the hinge accommodating unit **140***a* of the left side as necessary. Also, the movement restricting unit **150** may be disposed on all of the hinge units **130***a* and **130***b* and the hinge accommodating units **140***a* and **140***b* of the opposite sides as necessary.

According to a secondary embodiment of the present invention, as shown in FIG. **9**, a scanning apparatus **100** may include a hinge unit **130***b* disposed on a main body **120***a*, and a hinge accommodating unit **140***b* may be disposed on a cover **110***a* or on an automatic document feeder **110***a*.

The main body **120***a* includes a hinge pivot insertion unit **124** to which a hinge pivot **170** is inserted.

The positions to which the hinge unit **130***b* and the hinge accommodating unit **140***b* are disposed are opposite to those of the first embodiment, and detailed descriptions of the some elements will be omitted because they have the same configurations as the first embodiment.

An image forming apparatus (not shown) according to another embodiment of the present invention may further include the scanning apparatuses **100** or **100***a* described above, and an image forming unit (not shown) printing an image corresponding to an image of a document scanned by the scanning apparatuses **100** or **100***a* on a printing medium.

Here, the image forming apparatus may form an image by at least one of an inkjet type forming process forming an image on a printing medium with an ink, an electro-photographic type forming process forming an image on a printing medium with a toner, and a thermo-electronic type forming process forming an image on a heat sensitive printing medium by using a thermal printing head (TPH).

The inkjet type forming process has a printing head having a plurality of nozzles. The electro-photographic type forming process has an image carrying body (not shown) having an organic photo sensitive layer on an outer surface thereof, a light exposing unit (not shown) exposing a surface of the image carrying body to form an electrostatic latent image, a developing cartridge (not shown) developing the electrostatic latent image with a toner, a transferring unit (not shown) transferring the toner to a printing medium, and a fusing unit (not shown) fusing the toner transferred to the printing medium with heat and pressure.

As described above, a scanning apparatus and an image forming apparatus having the same according to aspects of the present invention have the following and or other effects.

First, safety of a user can be ensured in spite of mistake of the user.

Second, a scanning apparatus and an image forming apparatus can be easily repaired and maintained.

Third, scanning a thick document can be stably performed.

Although a few embodiments of the present invention have been shown and described, it will be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A scanning apparatus, comprising: a main body having a scanning unit; a cover to open and close upon an upper surface of the main body;

a hinge unit disposed on one of the main body and the cover so that the cover is rotatable with respect to the main body;

a hinge accommodating unit disposed on the other of the main body and the cover to accommodate the hinge unit so that the cover is movable in an upward and downward direction with respect to the upper surface of the main body; and

an movement restricting unit to restrict a movement of the cover in the upward and downward direction,

wherein the movement restricting unit comprises:

an engagement unit disposed on one of the hinge unit and the hinge accommodating unit, and

an internal protruding piece of an engagement projection disposed on the other of the hinge unit and the hinge accommodating unit to contact the engagement unit when the cover moves upwardly with respect to the upper surface of the main body, the internal protruding piece which selectively passes through one of a plurality of thru-holes formed in the upward and downward direction in the other of hinge unit and the hinge accommodating unit, which adjusts with respect to the other of the hinge unit and the hinge accommodating unit, and which allows the cover to travel along a distance in the upward and downward direction that includes having the cover contact the upper surface of the main body,

wherein if the internal protruding piece of the engagement projection passes through any one of the plurality of thru-holes, then a distance of travel for the cover is

limited over a range of travel in the upward and downward direction which includes the cover contacting the upper surface of the main body.

2. The scanning apparatus according to claim **1**, wherein the cover comprises an automatic document feeder which transports a document to be scanned to the scanning unit.

3. The scanning apparatus according to claim **1**, wherein the engagement projection is disposed on a position of the other of the hinge unit and the hinge accommodating unit at a predetermined interval distance in the upward and downward direction with respect to the engagement unit, and contacts the engagement unit if the cover moves upwardly with respect to the upper surface of the main body.

4. The scanning apparatus according to claim **3**, wherein the engagement unit and the engagement projection are detachably coupled to the hinge unit and the hinge accommodating unit.

5. The scanning apparatus according to claim **3**,

wherein the engagement projection comprises an accommodating unit coupling piece coupled to the hinge accommodating unit, and the internal protruding piece which protrudes towards an inner part of the hinge accommodating unit, and

wherein the engagement unit comprises a hinge unit coupling piece coupled to a lower part of the hinge unit, and an external protruding piece protruding to an outer part of the hinge unit to contact the internal protruding piece in an inner part of the hinge accommodating unit.

6. The scanning apparatus according to claim **5**, further comprising a coupler detachably coupling the accommodating unit coupling piece and the hinge accommodating unit.

7. The scanning apparatus according to claim **5**, wherein the hinge accommodating unit further comprises the plurality of thru-holes formed in the upward and downward direction to allow the internal protruding piece to pass through to adjust the predetermined interval distance between the engagement projection and the engagement unit.

8. The scanning apparatus according to claim **1**,

wherein the hinge accommodating unit comprises a hinge unit accommodating space formed in an upward and downward direction to accommodate the hinge unit, and

wherein the hinge unit extends in the upward and downward direction to slide in the hinge unit accommodating space.

9. The scanning apparatus according to claim **1**, further comprising an elastic member elastically biasing the cover so that the cover is rotatable to expose the upper surface of the main body.

10. An image forming apparatus, comprising:

the scanning apparatus according to claim **1**; and

an image forming unit to form on a printing medium an image corresponding to image data of a document scanned by the scanning unit.

11. The image forming apparatus according to claim **10**, wherein the engagement projection is disposed on the other of the hinge unit and the hinge accommodating unit at a predetermined distance interval in the upward and downward direction with respect to the engagement unit.

12. The image forming apparatus according to claim **11**, wherein the engagement unit and the engagement projection are detachably coupled to the hinge unit and the hinge accommodating unit.

13. The image forming apparatus according to claim **11**,

wherein the engagement projection comprises an accommodating unit coupling piece coupling the hinge accommodating unit, and the internal protruding piece which protrudes towards an inner part of the hinge accommodating unit, and

wherein the engagement unit comprises a hinge unit coupling piece coupled to a lower part of the hinge unit, and an external protruding piece protruding to an outer part of the hinge unit to contact the internal protruding piece in an inner part of the hinge accommodating unit.

14. The image forming apparatus according to claim **13**, further comprising a coupler detachably coupling the accommodating unit coupling piece and the hinge accommodating unit.

15. The image forming apparatus according to claim **13**, wherein the hinge accommodating unit further comprises the plurality of thru-holes formed in the upward and downward direction, allowing the internal protruding piece to pass through to adjust the predetermined interval between the engagement projection and the engagement unit.

16. The image forming apparatus according to claim **10**,

wherein the hinge accommodating unit comprises a hinge unit accommodating space formed in an upward and downward direction to accommodate the hinge unit, and

wherein the hinge unit extends in the upward and downward direction to slide in the hinge unit accommodating space.

17. The image forming apparatus according to claim **10**,

wherein the cover rotates in a direction of closing the upper surface of the main body by a self weight, and

wherein the image forming apparatus further comprises an elastic member elastically biasing the cover so that the cover is rotatable in a direction of opening the upper surface of the main body.

18. The scanning apparatus according to claim **1**,

wherein if the internal protruding piece of the engagement projection passes through one of the plurality of thru-holes, the distance of travel in the upward and downward direction is less than a maximum distance interval and the cover contacts the upper surface of the main body.

19. A method of coupling a cover of an image forming apparatus to a main body of the image forming apparatus, the method comprising:

coupling the cover of the image forming apparatus to the main body of the image forming apparatus with a hinge unit accommodated by a hinge accommodating unit to allow movement of the cover in directions perpendicular to a plane of a platen of the image forming apparatus;

applying a movement restricting force to at least one of the hinge unit and the hinge accommodating unit to restrict a movement of the cover in the directions perpendicular to the plane of the platen of the image forming apparatus; and

contacting an engagement unit disposed on one of the hinge unit and the hinge accommodating unit with an projection, which includes an internal protruding piece, disposed on the other of the hinge unit and the hinge accommodating unit to restrict the movement of the cover in the directions perpendicular to the plane of the platen of the image forming apparatus, the internal protruding piece which selectively passes through one of a plurality of thru-holes formed in the upward and downward direction in the other of the hinge unit and the hinge accommodating unit, which adjusts with respect to the other of the hinge unit and the hinge accommodating unit, and which allows the cover to travel along a distance in the upward and downward direction that include having the cover contact the upper surface of the main body,

wherein if the internal protruding piece of the engagement projection passes through any one of the plurality of thru-holes, then a distance of travel for the cover is limited over a range of travel in the upward and downward direction which includes the cover contacting the upper surface of the main body.

20. The method according to claim **19**, wherein the contacting the engagement unit comprises:

contacting the engagement unit with the internal protruding piece of the engagement projection at a predetermined distance interval in the upward and downward direction to restrict the movement of the cover in the directions perpendicular to the plane of the platen of the image forming apparatus.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 8,948,678 B2
APPLICATION NO. : 12/538393
DATED : February 3, 2015
INVENTOR(S) : Dae-Lim Shin

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Claim 1, Column 8, Line 54:

Delete “unit” and insert --unit if--, therefor (2nd Occurrence)

Claim 19, Column 10, Line 53:

Delete “an” and insert --an engagement--, therefor

Signed and Sealed this
Fifteenth Day of September, 2015

Michelle K. Lee

Michelle K. Lee
Director of the United States Patent and Trademark Office